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**Original article:**

# C – Reactive Protein as an indicator for complications in type -2 diabetes mellitus

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**Abstract:**

**Background:** Diabetes mellitus (DM) is characterized by chronic hyperglycemia and impaired carbohydrate, lipid, and protein metabolism caused by complete insufficiency of insulin secretion. Diabetes is a disease with chronic low grade inflammation. This inflammatory milieu promotes atherosclerosis and gives rise to other complications in diabetes.

**Aim and objective:** Assessment of C-reactive protein in type -2 diabetes mellitus with complications, without complications and controls.

**Material and Methods:** A total of 100 patients, 50 - Type-2 Diabetes mellitus with complications, 50 without complications for the last one year and 50 normal healthy individuals were chosen as control group.

**Results:** The results showed a mean values of Blood Sugar levels (F), Blood Sugar levels (PP), were significantly increased (P<0.0001) in type -2 Diabetes mellitus With complications, T2 DM. without- complications as compared to controls. Another mean values of C- reactive proteins were highly significantly increased (P<0.0001) in T 2 DM with complications, T 2 DM without complications as compared to controls.

**Key words:** Type-2 Diabetes mellitus with Complications, Type-2 Diabetes mellitus without complications, hyperglycaemia, C-reactive protein.

## INTRODUCTION:-

Diabetes mellitus (DM) is characterized by chronic hyperglycemia and impaired carbohydrates, lipids, and proteins metabolism caused by complete or partial insufficiency of insulin secretion and/or insulin action (1). The prevalence of diabetes is rapidly rising all over the globe at an alarming rate. Complications of diabetes include microvascular and macrovascular complications (2). The basic dysfunction common to all diabetic complications is the alterations in the microvasculature i.e., the small blood capillaries which carry blood to the different tissues of the body, being petite in nature, get affected

very easily to the varied environment prevalent in the body, which in case of a diabetic patients is the hyperglycemia. There are many events, initiated and stimulated by hyperglycemia, in the body of a diabetic patient which lead to a series of changes in the body at the molecular level which ultimately affect the structure of small blood capillaries (3). Diabetes is a disease with chronic low grade inflammation. This inflammatory milieu promotes atherosclerosis and gives rise to other complications in diabetes (4). C-reactive protein (CRP) is an inflammatory marker produced and released by the liver under the stimulation of cytokines such as tumour necrosis factor-α and interleukins. It affects the process of atherothrombosis (5). CRP plays an active role in atherosclerosis. Role of CRP as a marker of coronary artery disease has been well established (6, 7).

Hyperglycaemia is an associated factor for increment of serum CRP levels, in uncontrolled type-2 diabetic subjects. Serum levels of CRP are associated with complications of atherosclerosis such as myocardial infarction and stroke (8). The CRP level linked to an increased risk for later development of diabetes. Furthermore, CRP levels are higher in people with diabetes compared with those without diabetes (9).

**MATERIALS AND METHODS:**

The present study was carried out in the Department of Biochemistry and Central Investigation Laboratory in collaboration with the Department of Medicine of TSM Medical College and Hospita,l Amausi, Lucknow. The study was approved by Institutional Ethical and Research Committee to use human subjects in the research study. Informed consent was taken from patient and control subjects. 100 diabetic patients attending Medicine ward of the Hospital for the last one year have been included in this study. 50 type-2 diabetic patients of both genders with complications and 50 without complications have been evaluated. 50 healthy volunteers mainly medical staff members and their families have also been included in this study who served as controls. Patients on statin and aspirin therapy, type-1 DM, suffering from infective, inflammatory, allergic disorders, cardiovascular disorders, necrosis, malignancy, with trauma due to surgery, burns, fractures and having habit of alcohol and smoking and pregnant women were excluded from this study.

About 3 ml of venous blood was collected in vacutainer by means of sterile needle from anterior antecubital vein in fasting condition for estimation of fasting blood glucose and CRP. Furthermore, 1 ml of blood was again collected in similar conditions from all participants 2 hours after meal to estimate post prandial blood glucose, It was allowed to clot for few minutes and was subjected to centrifugation for 10 minutes at 3000 rpm to separate the serum and kept at -20°C until analysis was carried out. Concentration of serum fasting blood glucose, post prandial blood glucose was measured by GOD - POD Method (10). CRP was measured by Turbilatex Method (11).

Data was compiled and analyzed using by Un – paired t – test software package. It was expressed as mean ± S.D.

**RESULTS:**

Present study was carried out in the Department of Biochemistry of Tertiary Hospital. The total 150 subjects were studied of which 50 type -2 D.M. with complications, 50 types -2 D.M. without complications as compared 50 normal healthy individuals were chosen as control group.

**Table No. 1 : Distribution of type – 2 DM with complications, type – 2 DM without – complications Patients and control according to gender.**

| Gender | Type – 2 DM with complications. | | Type – 2 DM without complications. | | Control | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| ***Male*** | 39 | 78% | 34 | 68% | 33 | 66% |
| ***Female*** | 11 | 22% | 16 | 32% | 17 | 34% |
| ***Total*** | 50 | 100% | 50 | 100% | 50 | 100% |

**Table No. 2 : Age group mean value of T2 DM. With complications, without complications and control.**

| | Type – 2 DM with complications. | Type – 2 DM without complications. | Control. | *p value* |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | Mean ± SD | |
| **Age (years)** | 60.34 ± 9.68 | 49.10 ± 7.45 | 41.56 ± 9.61 | P< 0.0001 |

**Table No. 3 : Age and sex wise distribution.**

| Age Group ( in years) | Type – 2 DM with complications | | Type – 2 DM without complications | | Control | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| | No. (%) | No. (%) | No. (%) | No. (%) | No. (%) | No. (%) |
| 30-50 | 11 (22%) | 4 (8%) | 20 (40%) | 9 (18%) | 13 (26%) | 7 (14%) |
| 51- 80 | 28 (56%) | 7 (14%) | 14 (28%) | 7 (14%) | 20 (40%) | 10 (20%) |
| Total | 39 (78%) | 11 (22%) | 34 (68%) | 16 (32%) | 33 (66%) | 17 (34%) |

**Incidence of various complications:**

The incidence of various complications observed in this study is in the table No. 3 It is observed form the study that retinopathy total 52% (40% male and 12% female), peripheral neuropathy 36% (28% male and 8% female) and nephropathy 12% (10% male and 2% female) were the most common complications.



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**Table No. 4: Incidence of various complications.**

| Complications | Male | Female | Total (100) |
|---|---|---|---|
| Retinopathy | 20 (40%) | 6 (12%) | 26 (52%) |
| Neuropathy | 14 (28%) | 4 (8%) | 18 (36%) |
| Nephropathy | 5 (10%) | 1 (2%) | 6 (12%) |

**Table No. 5:** Biochemical parameters in type -2 D.M. with complications, type -2 D.M. without - complications. and control.

| Parameters | Type-2 D.M With Complications. (n= 50) (Mean ± SD) | Type – 2 D.M. Without Complications (n= 50) (Mean ± SD) | Control | Statistical Significant |
|---|---|---|---|---|
| BSL(F) (mg/dl) | 243.38 ± 50.12 | 191.12 ± 54.06 | 91.66 ± 10.77 | P< 0.0001 |
| BSL (P.P) (mg/dl) | 315.04 ± 75.56 | 280.62 ± 88.70 | 137.60 ±11.55 | P< 0.001 |
| C–reactive protein.(mg/L) | 12.56 ± 2.11 | 8.35 ± 1.32 | 5.34 ± 1.51 | P< 0.0001 |

P< 0.01 statistically significant, P< 0.0001 extremely statistically significant.

**DISCUSSION:**

Diabetes is a metabolic disorder associated with insulin resistance resulting in hyperglycemia. It is considered that hyperglycemia is itself an inflammatory condition. (12). The present study compared the concentration of CRP in obese DM Type2 patients, obese without diabetes, and normal body weight subjects without diabetes and assessed the relationship between CRP concentration and the presence of macrovascular and microvascular complications and controls.

Highly sensitive CRP and metabolic control parameters were assessed. CRP levels in obese diabetes subgroups and normoglycemic obese were similar and significantly higher than those in nonobese controls. No correlation was found between CRP and diabetes control parameters. There was a strong positive correlation between CRP level and body mass index in all groups. A multivariate analysis showed that DM2 and obesity are independent factors increasing CRP levels. Increased concentration of CRP in obese DM2 patients is related to obesity and diabetes itself. The lack of association between CRP and vascular complications remains unclear (13).

The role of chronic low-grade inflammation contributing to the pathogenesis of diabetes and its related complications is well known. Chronic hyperglycaemia induces oxidative stress and chronic inflammatory state which jointly contribute to the pathogenesis of atherosclerosis. C-reactive protein levels more than 3.0 mg/L were found to be associated with worse cardiovascular outcome (14).

In our study, age group mean values were statistically significant in Type – 2 DM with complications, without complications and controls (Table 2). Our result correlated well with finding showed by Wali.et al. (15). It has been observed that the serum level of C - reactive protein and serum glucose level of both females and males type 2 diabetes mellitus showed a statistically significant increase as compared with age matched control subjects, ($P < 0.05$). Our result correlated well with finding showed by Ehiaghe et al., (16).Present observations showed statistically significant elevation in the fasting blood sugar, post-prandial levels in Type 2- diabetes mellitus with complications, Type 2 DM without complication as compared with healthy controls ($P< 0.0001$).Present findings are in agreement with finding showed by et. al., (12) and Gamit et al. (17).

Our findings indicate that statistically significant serum C- reactive protein was elevated in Type 2 diabetic with complications, type - 2 DM Without complications as compared healthy normal person as a controls. CRP values showed highly statistically significant ($P< 0.0001$). Our study correlated well with finding showed by Bandyopadhyay et al., (4), Baig et al., (18). and Likitesh et al., (19).

Incidence of various complications has been reported in Table 3. It has been observed that retinopathy 52% (40% males and 12% females), peripheral neuropathy 36% (28% males and 8% females) and nephropathy 12% (10% males and 2% females) were the most common complications as compared to controls.

**CONCLUSION:**

In our study there is a disturbed FBS and PP levels in Type-2 DM with complications, Type-2 DM without – complications as compared to normal healthy controls. Serum C – reactive protein levels were increased in diabetic patients with complications, without complications as compared with controls.

**ABBREVIATION:**

| | |
|---|---|
| **FBS:** Fasting Blood Glucose | T 2 DM: Type-2 Diabetes Mellitus |
| **PP:** Post Prandial | GOD: Glucose oxidase |
| **CRP:** C-reactive protein levels | POD: Peroxidase |

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